JAPAN INTERNATIONAL COOPERATION AGENCY

DEPARTMENT OF HYDRAULIC
MINISTRY OF MINES AND ENERGY
CENTRAL AFRICAN REPUBLIC

THE STUDY ON GROUNDWATER DEVELOPMENT IN BANGUI CITY IN THE CENTRAL AFRICAN REPUBLIC

FINAL REPORT

VOLUME 1

MAIN REPORT

DECEMBER 1999

KYOWA ENGINEERING CONSULTANTS CO., LTD.
YACHIYO ENGINEERING CO., LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY

DEPARTMENT OF HYDRAULIC
MINISTRY OF MINES AND ENERGY
CENTRAL AFRICAN REPUBLIC

THE STUDY ON GROUNDWATER DEVELOPMENT IN BANGUI CITY IN THE CENTRAL AFRICAN REPUBLIC

FINAL REPORT

VOLUME 1

MAIN REPORT

DECEMBER 1999

KYOWA ENGINEERING CONSULTANTS CO., LTD.
YACHIYO ENGINEERING CO., LTD.

EXCHANGE RATE (as of June 1999)

US$ 1.00 = 627.23 FCFA

PREFACE

In respect to the request from the Government of the Republic of Central Africa, the Government of Japan decided to conduct the Study on Groundwater Development in Bangui City in the Republic of Central Africa and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Central Africa a study team headed by Mr. Masaaki Shindo of Kyowa Engineering Consultants Co., Ltd., in association with Yachiyo Engineering Co., Ltd. The team was dispatched seven times between March 1996 and November 1999.

The team held discussions with the officials concerned of the Government of Central Africa, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that findings of this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Central Africa for their close cooperation extended to the team.

December, 1999

Kimio Fujita
President
Japan International Cooperation Agency

December, 1999

Mr. Kimio Fujita
President
Japan International Cooperation Agency (JICA)

LETTER OF TRANSMITTAL

Dear Sir,

We have please to submit you the final report entitled "The Study on Groundwater Development in Bangui City in the Republic of Central Africa".

The main outputs from the Study are broadly grouped into two components. One is the Master Plan Study on policy for arrangement of the water supply system that covers water demand projected for the target year 2015 for Bangui City and its peripheral area. The other is the Feasibility Study for the groundwater development project, which was selected as the preferred project among those proposed in the Master Plan Study.

The report consists of the Summary Report, Main Report, Supporting Report, Data Book and Drawings. The Summary Report summarizes the results of all the studies. The Main Report contains the results of survey, analysis implemented at each step of the Study. The Supporting Report includes details of investigations and analyses for formulating the contents of the Master Plan and Feasibility Study. Data Book contains the data gained by analyses in the field survey. Drawings show each component of water supply facilities proposed in the Feasibility Study.

All members of the Study Team wish to express grateful acknowledgment to the personnel of your Agency, Ministry of Foreign Affairs and Embassy of Japan in Central Africa, and also to the officials of the Government of Central Africa for all assistance extended to the Study Team. The Study Team sincerely hopes that the results of the study will contribute to the future water supply project in particular and to socioeconomic development of Central Africa.

Sincerely,

進藤昌明.

Mr. Masaaki Shindo
Team Leader

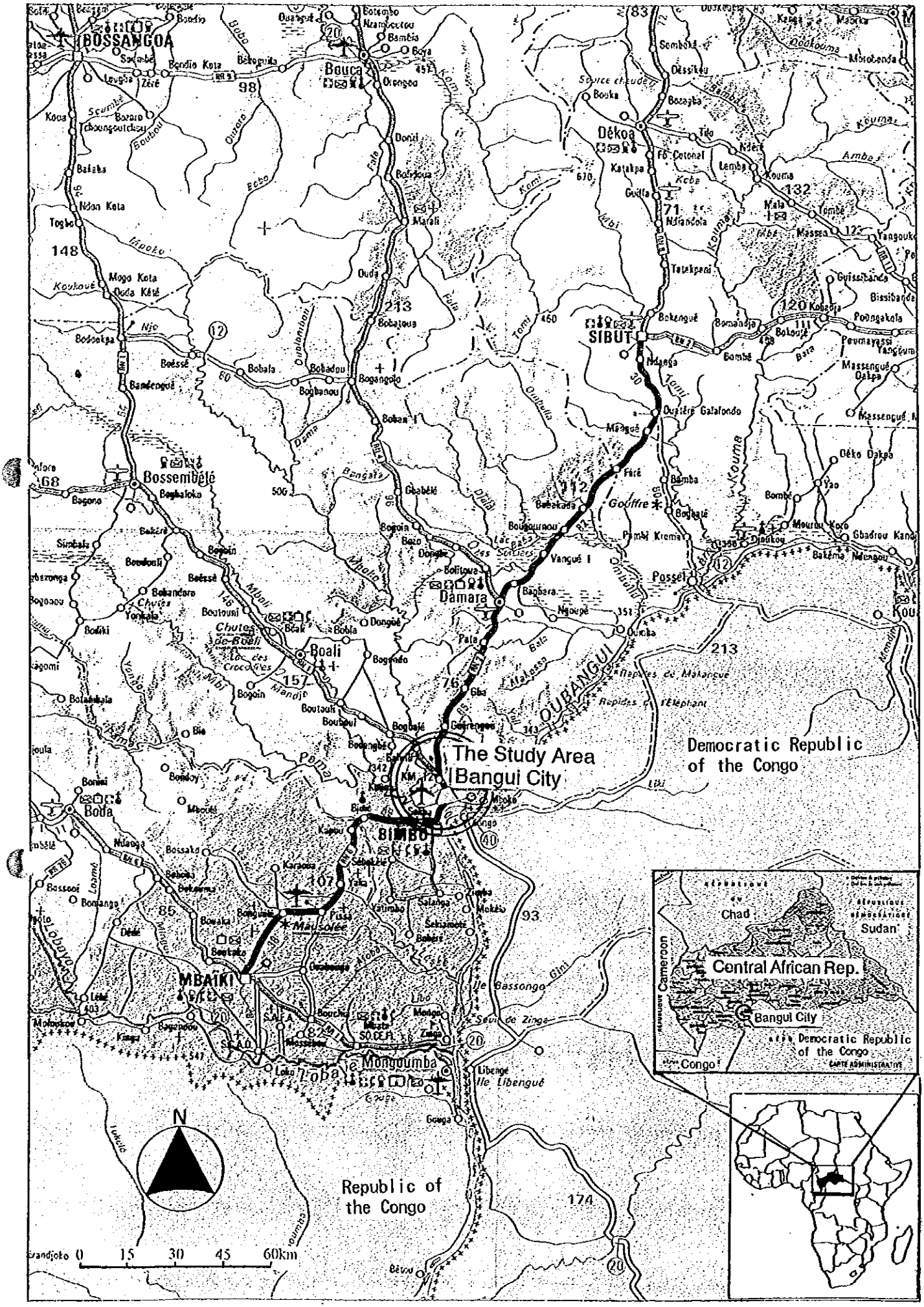
LIST OF REPORTS

SUMMARY REPORT

VOLUME 1 MAIN REPORT
- MASTER PLAN REPORT
- FEASIBILITY STUDY REPORT

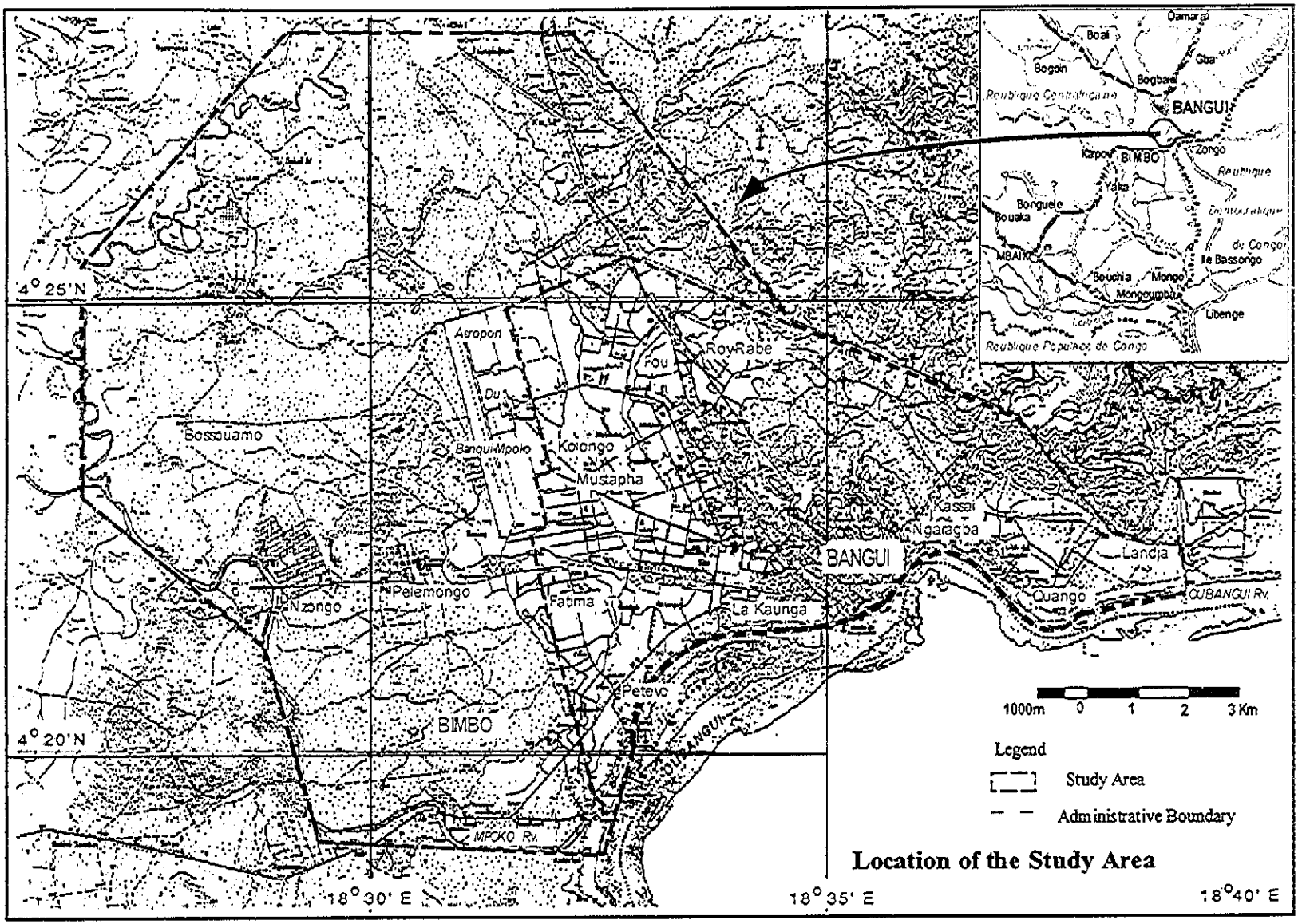
VOLUME 2 SUPPORTING REPORTS
1. SOCIOECONOMIC SURVEY
2. GEOPHYSICAL PROSPECTING
3. STUDY ON POTENTIAL OF SURFACE WATER
4. PRELIMINARY COST ESTIMATE ON F/S PROJECT
5. Fe & Mn ELIMINATION DEVICE
6. ANALYSIS OF WATER TARIFF

VOLUME 3 DATA BOOK
1. DRILLING REPORT
2. WELL INVENTORY SHEETS
3. GROUNDWATER QUALITY ANALYSIS RESULT
4. STUDY ON SURFACE WATER DISCHARGE
5. BOALI DAM WATER BALANCE CALCULATION
6. SOCIOECONOMIC ASPECT
7. DRAWINGS (FEASIBILITY STUDY)


BOSSANGOA
Bouca
Dékoa
SIBUT
Bossembélé
Damara
Boali
BIMBO
MBAÏKI
Mongoumba
The Study Area
Bangui City
Democratic Republic
of the Congo
Republic of
the Congo
Chad
Sudan
Cameroon
Central African Rep.
Congo
Bangui City
Democratic Republic
of the Congo
N
0 15 30 45 60km

MASTER PLAN

REPORT


4° 25'N
4° 20'N
18° 30' E
18° 35' E
18° 40' E
Aeroport
Fou
Roy Rabe
Du
Bossouamo
Bangui-Mpoko
Kolongo
Mustapha
Lassai
Ngaragba
BANGUI
Landja
Quango
CUBANGUI Rv.
Pelemongo
Nzongo
Fatima
La Kaunga
Petevo
BIMBO
MPOKO Rv.
Damara
Boali
Bogoin
Bogbara
Gbai
BANGUI
Zongo
Bimbo
Yaka
Bonguele
Bouaka
MBAIKO
Bouchia
Mongo
Mongoumba
Libenge
Republique Centrafricaine
Republique Populaire du Congo
1000m 0 1 2 3 Km
Legend
Study Area
Administrative Boundary
Location of the Study Area

THE STUDY
ON
GROUNDWATER DEVELOPMENT IN BAMGUI CITY
IN
THE CENTRAL AFRICAN REPUBLIC

MASTER PLAN REPORT

CONTENTS

Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
BHN	Basic Human Needs
CAR	Central African Republic
FCFA	Franc Communauté Financière Africaine
CFD	Caisse Francaise Development
DGH	General Department of Hydraulics
EIRR	Economic Internal Rate of Return
ENERCA	Energie Centrafricaine
FIRR	Financial Internal Rate of Return
F/S	Feasibility Study
GDP	Gross Domestic Product
IEC	Information Education Centre
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
MINURCA	Mission des Nations Unies en Republique Centrafricaine
MISAB	Mission interafricaine de surveillance des accords de Bangui
M/P	Master plan
MTAC	Ministry of Transportation and Aviation Civil
NGO	Non-Government Organization
ORS	Oral Re-hydration Solution
PHC	Primary Health Care
SCF	Standard Conversion Factor
SHE	Sanitation/Hygiene Education
SNE	Société Nationale des Eaux
SODECA	Société de Distribution d'Eau en CAR
S/W	Scope of Work
UNDP	United Nations Development Pogramme
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

LIST OF TABLES

LIST OF FIGURES

Chapter 1. Summary of Study

1.1 Background of study

The Central African Republic (CAR) has been considered as the one of African countries whose social infrastructure has been still developed at the lowest level. The water service coverage ratio in CAR is 18%. Even in urban areas only 20% of the population can access to the public water service. Therefore, the majority without water service relies on shallow wells or surface water. As the top priority has been given to the water supply infrastructure development by the Government of CAR in order to improve life conditions, some European donor agencies and the UNDP are now working on groundwater development in rural areas and provincial cities. Japan has been providing assistance in this regard through its Grant Aid program and by dispatching specialists to assist in these projects for more than 10 years.

Metropolitan Bangui, which consists of Bangui City, the capital of the CAR, and three urbanized sub-district of Bimbo District, has an estimated population of 660,000 in 1998. The annual population growth rate is estimated at 3.88% in Bangui and 7.91% in Bimbo in the past 10 years. As a result, insufficiency of social infrastructure becomes serious problem.

Bangui City has a water supply system whose source is the Oubangui River. Although the water distribution network has been furnished mainly in urbanized area of Bangui and also expanded toward the north and the west in the part of the sub-district of Bimbo. The current water service coverage is estimated at about 30%. Many of those without water service rely on unsanitary shallow wells for drinking water. This has often caused waterborne diseases. The French Government has mainly assisted CAR to construct and maintain the existing water supply system and to expand water distribution network by loan basis project in Bangui City and six main cities in the provincial. Presently, the rehabilitation of the existing water supply network in Bangui has been undertaken with financial assistance from Agence Française de Développement (AFD). However, specific plans have not been formulated for the development of new water resources and water service facilities in the west and the north areas which are located outside of the existing system.

Considering this background, in February 1995, the CAR Government requested the Japanese Government for technical cooperation in order to develop new water resources and new water service facilities in the Bangui metropolitan area. Accordingly, in

November 1995, JICA dispatched a delegation to the CAR to conduct a preliminary study of water supply conditions. Then the Scope of Work (S/W) was then agreed between the CAR and Japanese Government.

1.2 Objective of the Study

In order to ensure a stable and sustainable supply of sanitary drinking water to Bangui City and the peripheral areas where the water services do not currently exist, the following objectives were fixed.

e.g.

- Master Plan (M/P) (target year 2015) would be created
- Feasibility Study (F/S) would be conducted for particular projects to be formulated by the M/P which would be deemed to be highest priority.

The target year of F/S which was originally aimed at 2000 then had been changed to 2005 taking suspension and delay of the progress of study into consideration.

In addition to the above, the Study Team intended to transfer technological know-how to their CAR's counterparts who would participate in the study meanwhile undertaking the study.

1.3 Study Area

The Study area has a total area of 155 km^2 and composes entire Bangui City, the capital of the CAR and the neighboring sub-district of Bimbo District. (See Fig.1-1.)

1.4 Basic Policy of the Study

1.4.1 Scope of Work

(1) Study of developing water resource

1) Groundwater study

The development of groundwater resources is the main target in this Study. In order to develop economically feasible water resources, it is advisable to identify one central source of groundwater which enables to provide a large amount of the potable water.

The bedrock in the Study area was reported to be a wide distribution of crystalline

schist, limestone and bituminous shale. And over it alluvium structures with a depth of from 10 to 150 meters covers which consists of clay and silt with a nature of less permeability. Groundwater is expected to be found only in narrow spaces with cracks or faults in the bedrock.

Therefore, in order to make the potential of groundwater development obvious in the Study area the following investigation/examination were proposed.

- Landsat images and remote sensing methods so as to grasp macroscopically the topographical and geological features and natural water properties on a large scale
- Electrical and electromagnetic prospecting so as to clarify the distribution of the water resources in the Study area
- Evaluation the water yield capacity of the existing wells
- Estimation of the potential of groundwater based on the results of exploration wells to be drilled in the Study

In order to improve the technical knowledge and capabilities of local engineers, these engineers were envisaged participate both in the geophysical field survey and in analysis and evaluation of the results of that survey.

2) Study of surface water

The main water source of the study is groundwater. However, if the region's groundwater resources would be found to be insufficient, the water source can be altered to the surface water. The south part of Bangui City faces the Oubangui River which forms the borderline to Democratic Republic of the Congo, former Zaire. The west and northwest part of Bimbo City is encircled by the Mpoko River, which joins to the Oubangui. The amount of water flowing in the Mpoko was estimated to be at least 200,000 m^3 /day even in the dry season. Then it can be utilized as a water source which estimated at 20,000 m^3 / day to 30,000 m^3/day for additional drinking water in the future. Therefore, both the Oubangui and the Mpoko rivers were needed to be analyzed hydraulically and hydrologically.

From the point of location of the both rivers, they are considered to likely be contaminated by drainage form the cities, therefore, water quality of the both rivers was needed to be analyzed. The results of these tests should be incorporated into the plan.

(2) Social Analysis/Study on Patterns of Water Utilization

In order to identify obstacles for improving overall sanitary conditions and to

determine the best way cope with these matters, actual patterns of water utilization in the Study area would be investigated by means of questionnaire for residents. Based on the results of this part of the study, the Study Team envisaged to maintain social impartiality in the development of the region's water supply infrastructure. Specific issues to be analyzed were: equality access to public faucets, minimization of water-access differences among various socioeconomic groups, protection of water utilization rights for people living near actual water sources and the minimization of any relative affects of water supply development in the region.

(3) Formulating master plan and feasibility

The M/P consists a Water Resource Development Plan with the alternative of groundwater or surface water and planning of water supply facilities in the target year 2015. The M/P will be formulated based on the development plans of Bangui City; the population increases in each water distribution block, the standard of living and the overall economic situation. Moreover, it will be important to incorporate data concerning the social environment and people's consciousness that would be grasped by the social analysis / the study on patterns of water utilization through interviews to the residents. The plan will also need to be flexible enough to meet the financial conditions and the level of technical capabilities of the relevant local organizations.

During the F/S stage (which will be based on the result of evaluation of the M/P) only priority projects will be dealt with. Schematic designs of the various water supply facilities, facility maintenance plans, and operation cost estimations shall be determined, such that the design shall correspond to the target year of 2005. However, the scale of the above designs, structure of facilities and management system shall be drafted in a way that will reflect the extent of available Japanese Grant Aid.

(4) Technology transfer

Technical skill concerning well drilling and the maintenance of equipment has already been attained by local specialists to certain level. This is the result of various on-the-job training implemented through the groundwater development projects sponsored by the Japanese Government. The training was also accomplished in the CAR through contact with JICA's long-term specialists. However it is necessary for them to improve their technological know-how such as methodology of planning and future projection corresponding to the social developments in the region. For such purposes, some of the counterpart specialists would be chosen at the beginning of the Study and let

them participate in the work of collecting and treating data, estimating the future frame value and the way of monitoring the planning, etc. Through the above manners, transferring the technology of planning, investigation and analyze concerning groundwater development, etc. would be effectively conducted among the CAR counterpart engineers.

1.4.2 Schedule and Program of the Study

Initially, the period of the Study was totally scheduled for 19 months from March 1996 and to finish in October 1997 (See Fig.1-2). However, the military clashes on a small scale in April 1996 and the battle between mutineers versus national military in which pillages had happen and citizens were involved in May of 1996 forced the study to suspend. After the mutiny ended, in order to confirm the condition to resume the Study, a tentative delegation was dispatched in August of 1996. Then in October of 1996 the Study was restarted for geophysical survey and test drilling of wells. However the mutiny broke out again in November 1996, the Study Team had to interrupt the study and left from the CAR. In the end of December 1996 it was determined that the Study could not be continued within the Japanese fiscal year 1996 (means to March 1997) because there was few possibility to end the mutiny in near future.

Over one year interval, in May 1998 the Study was resumed and begun with construction of the access road for the drilling work (entrusted work to a local contractor). The work of exploration well drilling (total 20 wells: 10 wells by a local contractor as entrusted work, 10 wells by the CAR counterpart) followed under a supervision of the Japanese exports in August 1998. In December, a group of Experts was dispatched to CAR in order to evaluate a potential of groundwater development through the result of exploration well drilling and formulate a methodology of the Master Plan targeted at the year 2015.

The second stage of the Study, which includes feasibility study, evaluation of the project, etc., will be commenced from May 1999. Accordingly, the whole study is expected to be finished in November of 1999, about 2 year behind from the original schedule (see Fig.1-3).

The following works were entrusted to local contractors and completed during the first study stage.

Table 1-1 Progress of Entrusted Works Implemented During the 1st Stage of the Study

Entrusted Work	Term of Implementation
a. Topographic survey of river cross section	April 1996
b. Water quality analysis on River water and existing deep wells	May ~ December 1996
c. Social analysis/Study on patterns of water utilization	May 1996
d. Exploration wells drilling	August 1998 ~ January 1999
e. Water quality analysis on exploration wells	September 1998 ~ January 1999
f. Topographic survey on access road	September 1996
g. Construction of access road	June ~ July 1996

1.4.3 Organization of Study Implementation

In order to arrange the implementation of the Study, The CAR Government established the Steering Committee as supreme organization which was composed of representatives of following 7 ministries and 7 organizations.

- Ministry of Mines and Energy
- Ministry Delegated to Economy, to Plan and to International Cooperation
- Ministry of Public works, of Habitat and Arrange of territory
- Ministry of Administration of territory and National security
- Ministry of Transportation and Aviation Civil (MTAC)
- Ministry of Women and Social Development
- Ministry of Health and Population
- National Committee of Water supply and Drainage
- Municipality of Bangui City
- Société Nationale des Eaux (SNE)
- Société de Distribution d'Eau en CAR (SODECA)
- Energie Centrafricaine (ENERCA)
- The Japanese Embassy
- JICA Study Team

JICA Study Team was composed of 15 members: 14 specialists and an interpreter as follows.

NAME	CHARGE TO BE TAKEN
Mr. Masaaki Shindo	Team Leader / Groundwater Development
Mr. Yosuke Sasaki	Sub-team Leader / Hydrogeology
Mr. Toshio Murakami	Topographic feature / Geology
Mr. Shigeo Otani	Hydrology
Mr. Hiroshi Nakamura	Electrical Resistively sounding
Mr. Satoshi Maruyama	Electromagnetic survey
Mr. Yoichi Harada	Supervision on Construction of Access Road
Mr. Takushi Matsunaga	Instruction of Well Drilling
Mr. Masayuki Taguchi	Sub-team Leader /Water supply planning / Facility plan
Mr. Naoki Hara	Economy / Finance /Organization
Mr. Keita Yonezawa	-do-
Mr. Satoshi Sugimoto	-do-
Mr. Serge Bouniatian	Social Analysis /Environment
Mr. Mutsumi Tsubouchi	-do-
Mr. Makoto Chiba	Interpreter

The principal members of the CAR side was composed mainly with engineers of General Department of Hydraulics (DGH) which is the executive organization of the Study under the Ministry of Mines and Energy. The key members of the Counterpart Team were as follows.

NAME	CHARGE TO BE TAKER
Mr. André Nalke Dorogo	Head of mission of Mineral Resources Ministry of Mines and Energy
Mr. Etienne M´peco	General Director/General Department of Hydraulics (DGH)
Mr. Barthélémy René Garama	Coordinator of Technical Project (DGH)
Mr. Desiré Ndemazagoa	Water Supply engineer (DGH)
Mr. David Tenguere	Well construction engineer (DGH)
Mr. Omar Chaib	Geo-physician (DGH)
Mr. Tean Ouaninga	Geo-physician (DGH)
Mr. Althanse Yambele	Hydrological engineer (MTAC)
Mr. Joachim Kozo	Water Supply engineer
Mr. Jonas Amakai Ibra	Chief of Socio-economic Section (DGH)

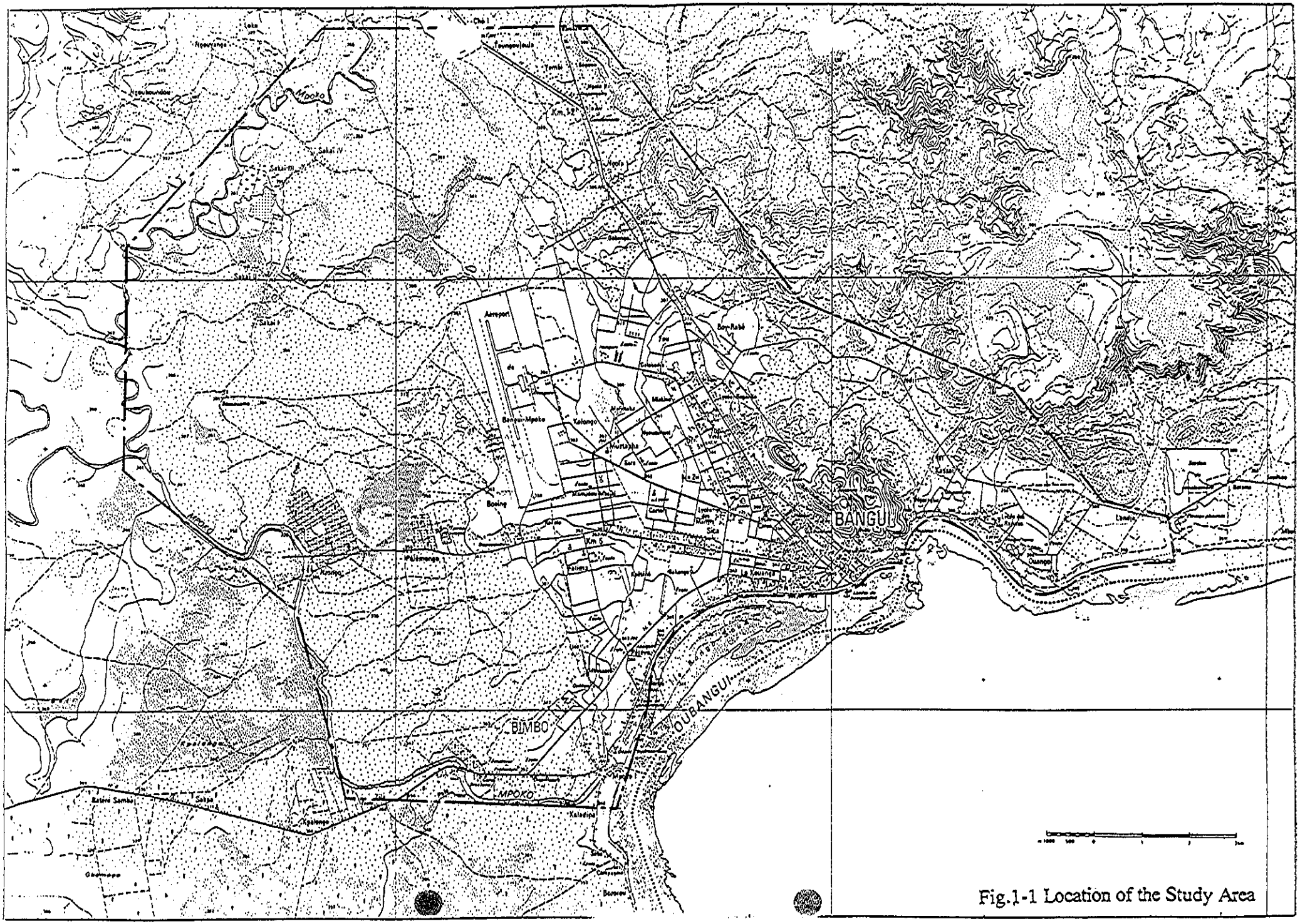


Fig.1-1 Location of the Study Area

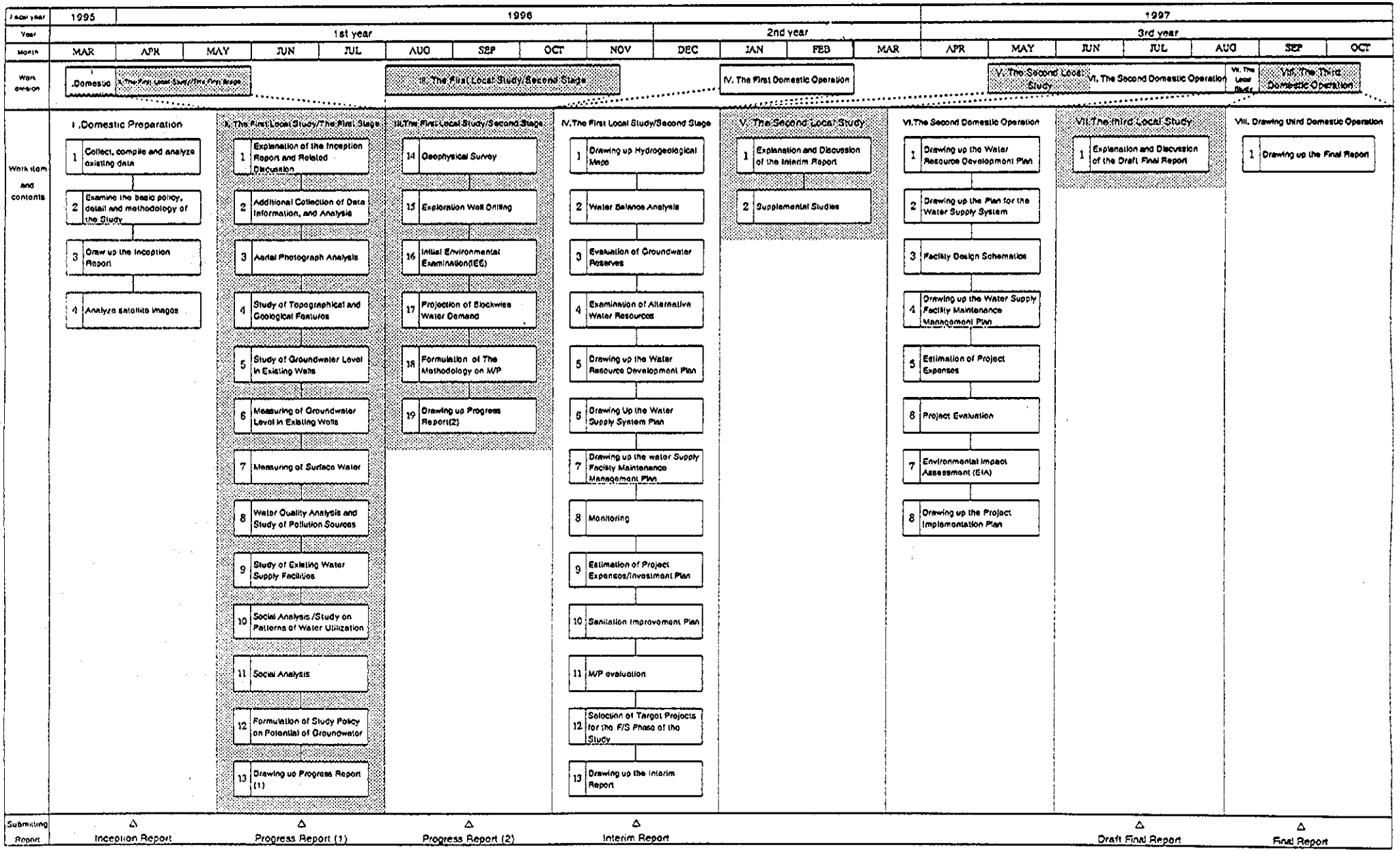


Fig. 1-2 Schedule of the Study (Original)

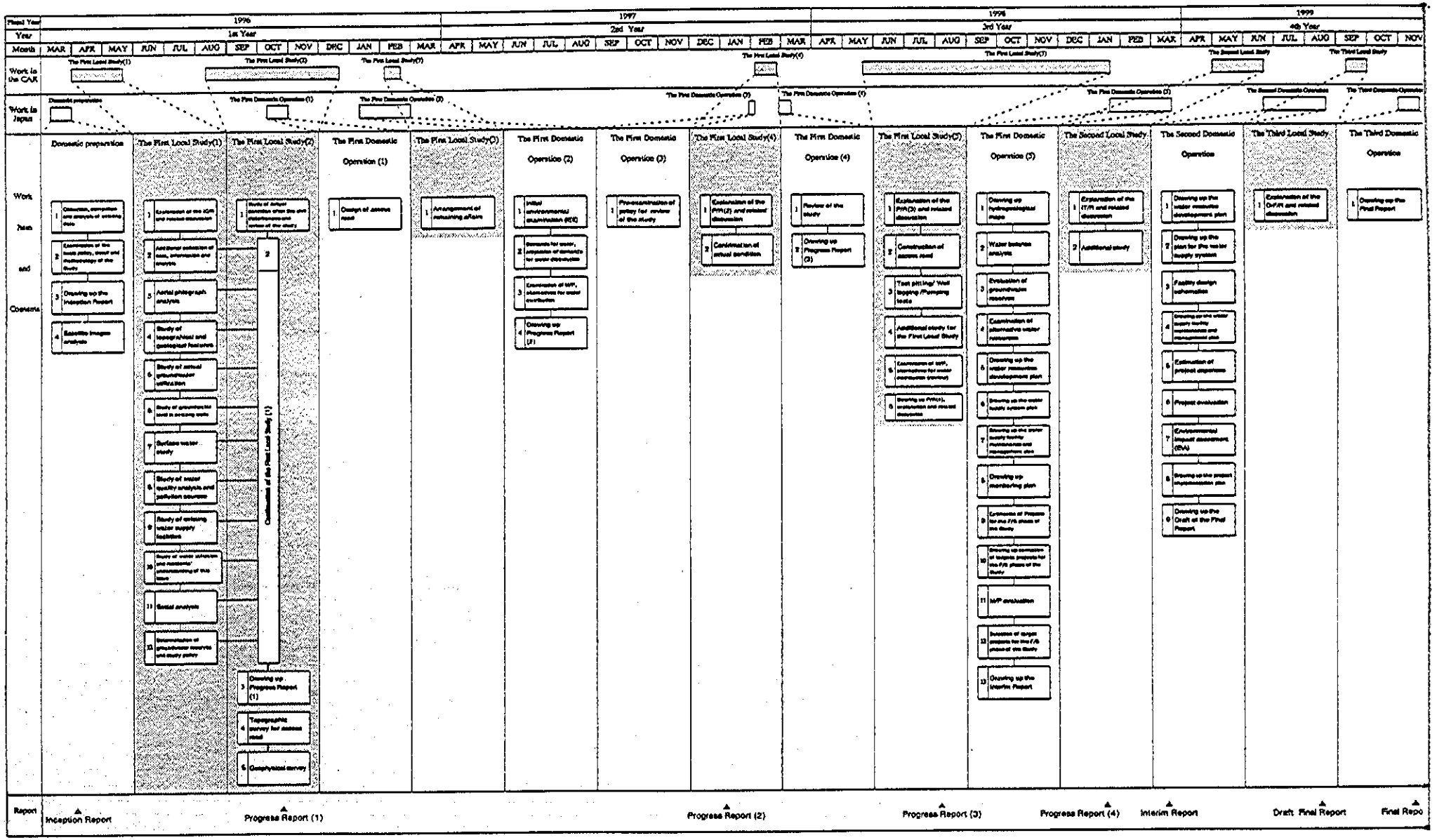


Fig. 1-3 Schedule of the Study (Revised)

Chapter 2. General Condition of the Study Area

2.1 Natural Condition of the Study Area

2.1.1 Geomorphological and Geological Aspects

(1) Geomorphological Aspects

The Study Area can be geomorphologically divided into following four units based on the aerialphoto interpretation as shown in Fig.2.1.1:

- Hill (Hl)
- Piedmont (Pd)
- Alluvial Plain (Al)
- Plateau (Pl)

a. Hill

The Hill is standing in the eastern side of the Study Area and its western edge is bounded by the steep escarpment running in NNW-SSE direction with relative height of around 300m to the Alluvial Plain. The Hill has flat top at the elevation of 600 to 650m showing the table land features. The hill is composed of Precambrian basement rocks such as chert, quartz schist, slate and so on and covered with the tropical rain forest.

b. Piedmont

The Piedmont lies on the foot of the escarpment in the eastern side of the Study Area. The Piedmont is gentle slope with inclination of 1/500 and its elevation ranges 370m to 400m. The piedmont extends in NNW-SSE direction with width of around 2 km. Many small towns and villages are distributed on the Piedmont and it is covered with cultivated land of cassava, mango and etc. The piedmont is covered with reddish brown lateritic clay.

c. Alluvial Plain

The Alluvial Plain distributes in the central part of the Study Area forming the low-land with the elevation of 340m to 360m. It shows almost flat plain feature with few undulation and dissection and it declines very gently toward the Oubangui river with the elevation of 370m to 440m. Many houses and farms are distributed on the Alluvial Plain with some forests. Pale gray sandy silt layer widely distributes on the Alluvial Plain.

d. Plateau

The Plateau has gently undulated land surface with many depressions and small valleys and distributes in the west and north of the Study Area surrounding the

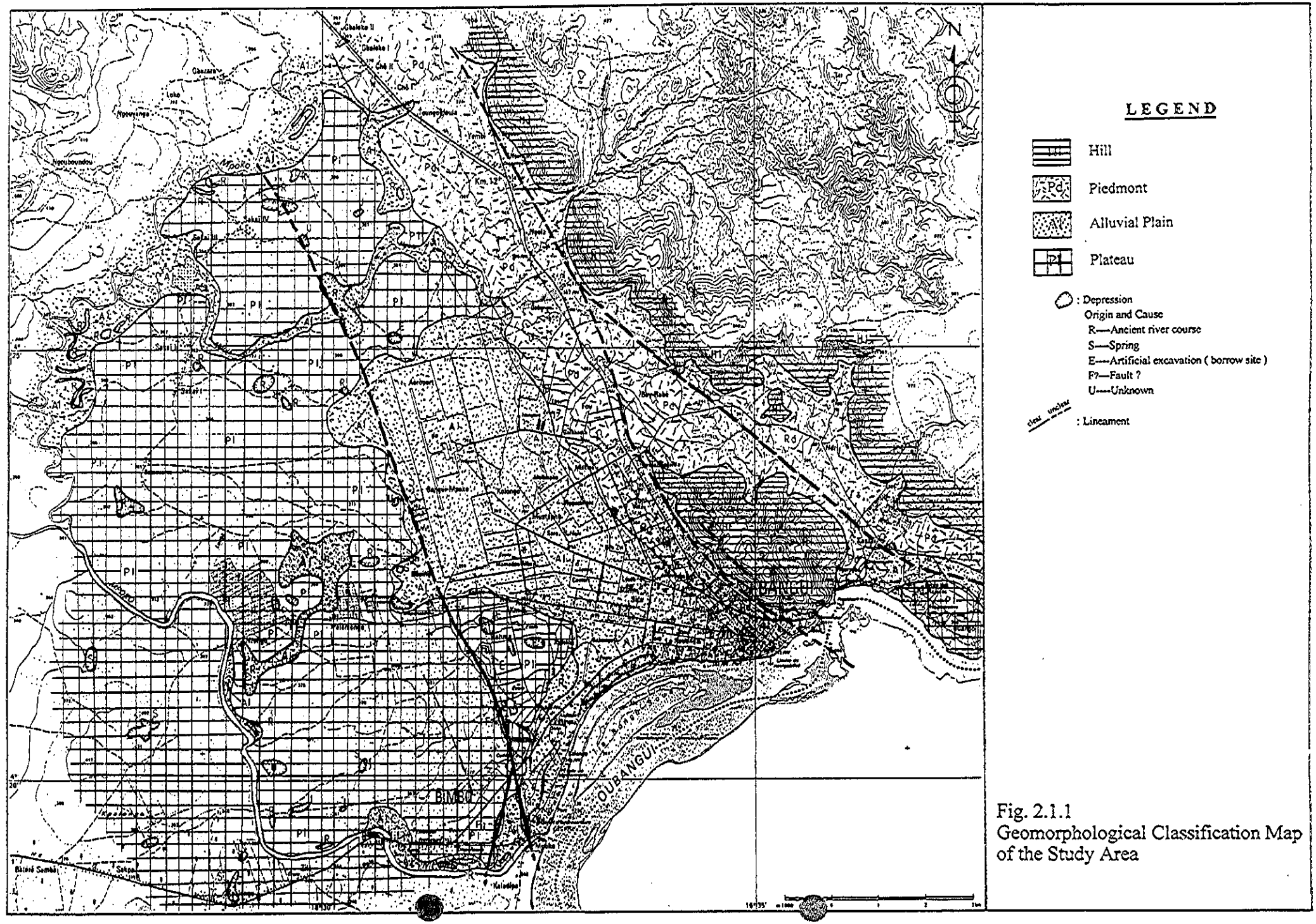


Fig. 2.1.1
Geomorphological Classification Map of the Study Area

M-2-2

Bangui City with the elevation of 360m to 400m. Some villages and farms are scattered on the Plateau and the tropical rain forest widely covers it. The plateau is covered with reddish brown laterite clay.

(2) Geological Aspects

1) Stratigraphy

The geology of the Study Area is composed of following strata.

i Overburden

-Quaternary sand

-Tertiary claystone, sandstone and conglomerate

ii Bedrock

-Precambrian quartzite sandstone, quartz schist and limestone

The stratigraphy of the Study Area is shown in next table. The geological distribution is shown in Fig.5.1.1 to Fig.5.1.3 of chapter 5.

Table 2.1.1 Stratigraphy of the Study Area

	Geological Age		Lithology
Overburden	a. Quaternary System		Sandy silt
	b. Tertiary System		claystone, Sandstone, Conglomerate
Bedrock	c. Upper Precambrian Group	Fatima Series	Limestone, Calcareous schist
		Bangui Series	Quartzite sandstone
		Yangna Series	Quartz schist

a. Quaternary System

The sandy silt layer consists of pale gray unconsolidated sandy silt and it widely covers the Alluvial Plain. Its thickness is around 1m to 3m. It is supposed that the sandy clay layer was derived from the ancient flood of the Oubangui River.

b. Tertiary System

Tertiary System is composed of semi-consolidated to consolidated claystone, sandstone and conglomerate and they almost turned into reddish brown lateritic clay, clayey sand and clayey gravels by the severe weathering. The thickness of the Tertiary System greatly changes from 25m to over 175m place to place.

c. Precambrian Group

The Precambrian group mainly consists of quartzite sandstone, quartz schist and limestone in the Study Area. The quartzite sandstone and quartz schist are highly cemented and hard and occasionally changes their phase to pelitic. The limestone in the Study Area is characterized as crystalline massive limestone and its lithoface

turns pelitic (calcareous shale) in the western part.

2) Geological Structure

a. Fault

The graben (depression) in N-S direction was found in the Study Area as shown in Fig. 5.1.1 through the geophysical survey and exploratory well drilling. Detail of the graben will be discussed in chapter 5.3. The graben is bounded by faults and formed by the dislocation of the faults movement as shown in Fig.5.1.2 and Fig. 5.1.3.

The Fault in the west flank of the graben can be traced as a clear lineament running along the boundary between the Alluvial Plain and the Plateau in the west part of the Study Area. It runs from the mouth of the Mpoko river to the Bangui-Mpoko airport in NNW-SSE direction. Some depressions are formed along this lineament with springs and wetlands. The east side fault is detected along the foot of the escarpment. It bounds the Hill and the Piedmont in NNW-SSE direction which is almost parallel with the fault in the west side . The east side fault is seemed to branch to the Kasai area.

b. Depression

Many depressions are found in the Plateau through the aerialphoto interpretation. It is reported that *'Paleo Crypto-Karst Topography'* which is underlain with the limestone layer is found in the vicinity of the Bangui City according to the existing report. But, such topographic features which was formed by the karstification cannot be found through both of the aerialphoto interpretation and field reconnaissance in the Study Area. Therefore, it is concluded that many of the depressions in the Study Area are the traces of the ancient river course and others are formed by springs and human activities (borrow site of clay).

2.1.2 Climate

The Central African Republic (CAR) is located in between 2° to 12° of north latitude. The climate belongs to a mix of the Guinean forest climate and Sudano-Guinean climate which is characterized by a humid tropical equatorial.

In the study area the climate is composed of dry season, which is a comparatively short period form December to March, and rainy season from March to November. In August it has the heaviest rain in the year. In accordance with meteorological data of the last 19 years, a minimum annual rainfall occurred in 1989 with 1,103mm per annum. A maximum one, on the other hand, was recorded at 1,794mm in 1998. Accordingly the mean annual rainfall was calculated at 1,443mm. It was observed that the rainfall was decreasing between 1953 and 1987, however, it has a trend to increase of rainfall from then. The maximum monthly temperature was recorded between about 35°C in February and 30°C in July. On the other hand, the minimum monthly temperature ranges from 23.5°C in April to 17°C in January. Concerning a temperature difference in a day, between the highest and the lowest, the maximum was recorded at 16°C in January and the minimum was at about 10°C in April, May and June.

2.2 Socioeconomic Aspect

2.2.1 Politics and Socioeconomy of the Central African Republic

(1) Political Background

After the outbreak of mutinies in April, May and December 1996, Bangui city has been in a relatively stable and peaceful situation in terms of security, owing to continuous peace-keeping efforts by multinational forces.

In 1997, however, some troubles based upon the dissonance between the government and the former mutineers' power were reported. In late March while Mission interafricaine de surveillance des accords de Bangui (MISAB), comprising approximately 700 soldiers from Burkina Faso, Chad, Gabon, Mali, Senegal and Togo with logistical support from French military forces (that took a back seat of peace-keeping operations), tried to disarm the former mutineers, 20 MISAB soldiers were killed; since a spokesman for the rebel claimed that the lack of representation of the former mutineers in the new 'Government of Action' (formed February 1997), a meeting between the spokesman and President Patassé was held in early April and the Council of Ministers was expanded to include representatives of the rebels; in mid-April a dusk-to-dawn curfew was imposed on Bangui (changed into midnight-to-dawn later but valid still at present); after several attacks to the French Embassy violent clashes erupted again between MISAB forces and the former mutineers in late June; after the negotiation between the chairman of MISAB and the representative of rebels, they reached a cease-fire agreement at the beginning of July and all the former mutineers were to be reintegrated into the regular armed forces and their safety was guaranteed.

These events are backed up with the fact that the main cause of the conflict between the government and the opposition has been transformed from the failure to pay salaries of the public-sector labor force to regional / ethnic problems: the former mutineers, who belong to the Yakoma tribe of the former President Kolingba, have been demanding the resignation of Patassé.

Although France, the former colonial power, sustains principal domains in budgetary and bilateral development aid to CAR, the French authorities announced the gradual withdrawal of their military forces from the country at the end of July 1997 and the first contingent of French soldiers left in October. Since MISAB is also planning to be evacuated from CAR reportedly by the end of spring 2000, the government and relevant authorities are afraid that the political

stability would become more fragile.

On April 15, 1998, MISAB was replaced by UN peace-keeping operational forces named MINURCA (Mission des Nations Unies en Republique Centrafricaine). As CAR's political/social situation has become relatively stable, reduction of the number of soldiers and withdrawal of MINURCA as a whole have been discussed for a while. On February 27, 1999, however, the UN Council has finally extended the mandate of MINURCA until November 15 to allow for the conduct of presidential elections to be scheduled this year.

From November through December 1998 (first round: November 22; second round: December 13) elections for the National Assembly were successfully conducted and the new government was formed. The majority party is the Mouvement pour la Libération du Peuple Centrafricaine (MLPC; leader: President Ange-Félix Patassé) which won 47 seats in this election, but could not reach more than a half of the total number of the seats: 109. To maintain good relationship to the second power in the Assembly, the Rassemblement Démocratique Centrafricaine (RDC; leader: Previous-President André Kolingba), that won 20 seats in the Assembly, and/or to the third, the Mouvement pour la Démocratie et le Dévelopment (MDD; leader: Former-President David Dacko), that won 10 seats, is supposed to be the key to success in managing stable governance of the country.

(2) Economic Affairs

According to estimates by the World Bank and IMF, CAR's gross domestic product (GDP) per capita at constant 1985 prices from 1992 through 1997 are respectively (unit: 1,000 CFA francs), 134.17, 131.65, 135.04, 140.03, 134.94, and 138.75. These figures tell not only that 1996 mutinies seriously affected the CAR's national production (-3.6% growth compared to the previous year), but also there have been no significant improvement in terms of people's living standard in recent 6 years.

GDP by sector also shows the mutinies' aftermath in the economic domain: the amount of production by the secondary sector (manufacturing / mining) reached 66.4 billion CFA francs (17.5% of total GDP) at its peak in 1995, but declined to 58.8 bil. (15.6% of total GDP) and 56.7 bil. (14.5%) respectively in 1996 and 1997; the tertiary (service) sector's production that recorded the highest amount in 1995 (103.0 billion CFA francs, 27.1% of total GDP), also declined in 1996 (98.7 bil., 26.2% of total GDP) and 1997 (99.7 bil., 25.5%) (see Table 2.2.1 and Fig. 2.2.1).

Since the early 1990s stagnating international markets of coffee and cotton products and a sharp increase in illegal trade across the border have damaged CAR's foreign currency earnings and tax / customs revenue. The government's mismanagement to maintain enough resources for expenditure on social services and salaries of public-sector employees have also begun since around this time. Although the CAR economy rejoiced a restoration of export competitiveness owing to the devaluation of the CFA franc (by 50%) in relation to the French franc in January 1994, the government lost control over a mounted budgetary deficit and failed once again in payment to public officials and eventually caused the mutinies in 1996.

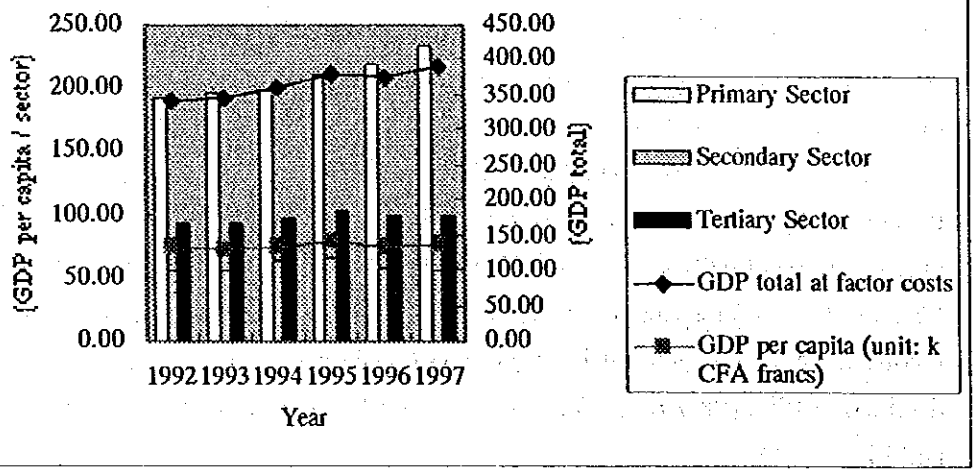
Table 2.2.1: CAR Gross Domestic Product at Constant 1985 Prices
1992 - 1997

(unit: billion CFA francs)

	1992	1993	1994	1995	1996	1997
Primary Sector	192.10	197.00	199.30	211.00	219.90	234.30
Secondary Sector	55.50	56.10	63.50	66.40	58.80	56.70
Tertiary Sector	93.00	92.20	97.60	103.00	98.70	99.70
GDP total at factor costs	340.60	345.30	360.40	380.40	377.40	390.70
GDP per capita (unit: k CFA francs)	134.17	131.65	135.04	140.03	134.94	138.75

Source: *Central African Republic: Statistical Annex* (IMF, 1998)

Fig. 2.2.1: CAR Gross Domestic Product at Constant 1985 Prices, 1992-1997 (unit: billion CFA francs)



In November 1996 the government signed a letter of intent with the World Bank and IMF for economic rehabilitation and development. The planned withdrawal of French troops (announced in July 1997) and Mission des Nations Unies en Republique Centrafricaine (MINURCA, former Mission interafricaine de surveillance des accords de Bangui: MISAB) forces from CAR, however, is anticipated to have an adverse effect on the economy, accompanied with predictable loss of domestic employment and foreign currency.

(3) Social Situations

Social situations for the population in Bangui have not improved yet. Payment of salaries to employees of the public-sector has been still delayed for about 9 months. Pension for retired public officials, including veterans, has been frequently suspended. Although inflation rate is relatively low and consumer prices of bare necessities (e.g. market prices of food) have been stable within these two years, prices of imported goods in general are consistently uprising. As a result of the implementation of IMF rehabilitation programs, since the end of 1996, high percentage of public officials were laid off. Decaying economy created a serious extent of unemployment nationwide over the period, especially in urban areas. Closedown of several factories, such as of textile and cigarette industries, and decline of foreign direct investment seriously affected on it. Employment in service sector retreats, especially due to gradual withdrawal of French troops and other foreign residents.

2.2.2 Urban Infrastructure

Urban Population was stable at about 20% in 1950s. However, It started to increase in 1970s and in 1975 reached to 27% and in 1988 to 38%. This trend is not changed yet. Population increase raised by a natural factor due to a birth rate and a social factor due to transmigration from the rural area causes to multiply urban problems. Bangui City which has a 660,000 population as of the end of 1998, which corresponds to 20% of total population of the CAR, are facing a serious urban problems.

In Bangui City only 6% of household has modernized flush toilet. While 80% of the same has latrine type toilet which is made easily by digging in the concession, shallow groundwater is contaminated by intrusion of faeces or drained water from household. In Bangui City and its surrounding area there are many people rely on unsanitary shallow wells. Therefore, it is highly recommended that these shallow wells shall be closed and changed to utilize the public water service.

In the city there are a 24km of main canal of drainage and a 10km of the secondary canal. A 15km of these canals needs to be rehabilitated. The drainage system in the city is not sufficient. In the rainy season, because of luck of capacity of the drainage, not only many houses are inundated here and there but also all the dug wells are filled with the inundated water and faeces in the latrines flow away.

There are a 56km paved road and a 48km unpaved road in Bangui City. A 38% of the paved road and a 16% of the unpaved road are well maintained. In the outskirts of Bangui City a settlement of people from the rural area is disorderly spreading without proper road arrangement. The poor road arrangement causes difficulty of construction of facilities of water supply drainage and electric supply etc.

The west and north areas of Bangui City, which belong to sub-district of Bimbo, are directly affected by urbanization of Bangui City and people in these areas are exposed to a high risk of sweep of diarrhea or water born diseases.

2.2.3 Living Condition

1) General

The social service is deteriorated both in quality and in quantity. Shortage of national budget is a basic and constant problem.

School teachers, who represent highest ratio in public-sector employees, started a strike requiring payment for delayed salaries in September 1998. In January 1999, public primary schools are still closed. Several public secondary schools are open with intern teachers.

Health sector also suffers from financial and management problems. Since Bamako-initiative, the government has been realizing the policy and running community-based primary health care programs. It means that each community's health center must compensate running costs by themselves except salaries to specialists among government employees. In practice, project management is the bottle-neck at the community level. Government employees in the health sector also got delay of payment for 8 to 9 months. Now it is almost impossible for the government to run social-affair programs due to shortage of fund.

Few gender programs among them are carried out. Additionally social investment is marginal, therefore social infrastructure as schools and hospitals are hardly improved or even poorly maintained.

Several diseases strain socio-economic conditions in CAR. Parasite disease, malaria, diarrhoeal disease are most common diseases. Conspicuously AIDS becomes a very serious problem. Reportedly among maternal examination receivers in Bangui, 14% of them are HIV positive.

Poverty remains an essential problem among the population. Their basement of lives has been fragile due to rising prices of some basic daily goods, high unemployment rate, shortage of social services and delayed payment of salaries. National economic reform is the main task at this point.

2) Household situation

People in CAR have generally large households. People have ' extended families' . That means there is core family and extended relative members living together. The number of inhabitants per household varies from place to place. The result of the studies shows the average number of habitants per household. (Fig. 2.2.2 No. of inhabitants) In

urban area, 8.7, in sub-urban area 9.4 and rural area 6.7. In sub-urban area, there is slightly more than other area. This is because in urban area there is no more space to extend their household therefore it is physically impossible to accept more people. In the sub-urban area, there is more space and it is relatively easier to access to urban service (water supply, electric supply employment and etc.) and life is still a little cheaper than urban area (See, Fig. 2.2.5 Monthly expenditure). Therefore they can maintain most number of habitants.

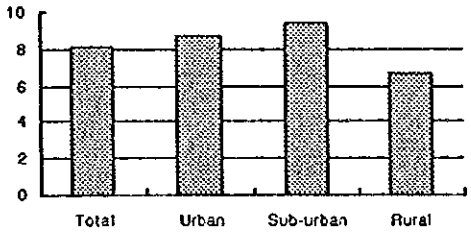


Fig. 2.2.2 No. of inhabitants per household

The Fig.2.2.3 shows the percentage of total household member by age obtained in 1996 study. Relatively high rate of member age between 15-30 is seen. The reason is assumed that firstly this study was sampled around Bangui, therefore there are people come from rural area seeking work who are mostly between 15 to 30, and secondly people tend to forget to count smallest members of the family.

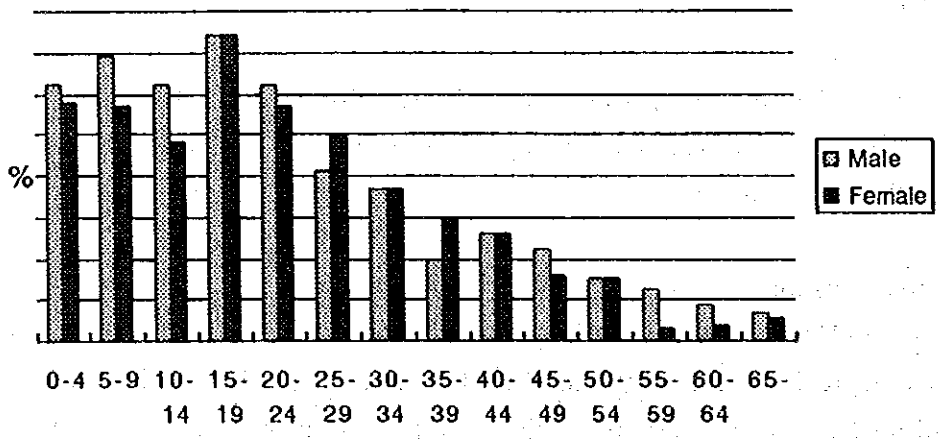


Fig. 2.2.3 Percentage of total household member by age (%)

Next Figure show occupation of people.

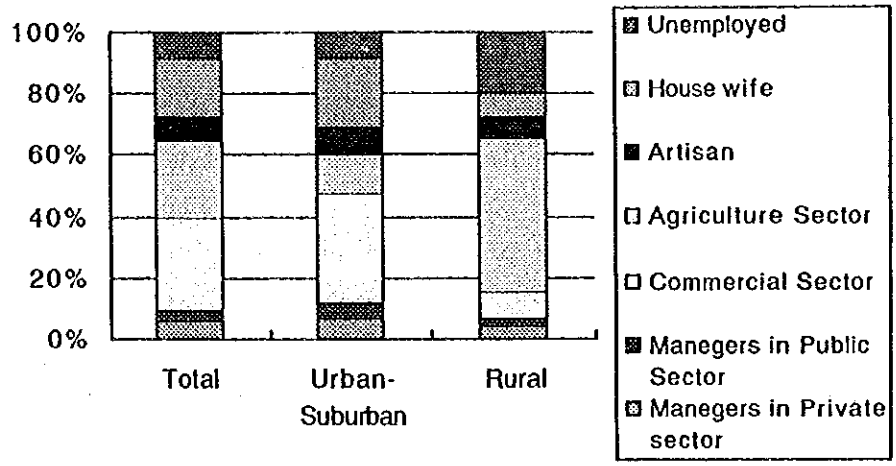


Fig.2.2.4 Occupation of people (%)

The people in urban / sub-urban area work in mainly in the commercial sector, in rural area agriculture. In rural area, there are few percentage of house wives, the reason is assumed that women are also occupied for agricultural activities, therefore they consider themselves as agriculture labor force.

Monthly expenditure is shown in Fig. 2.2.5. This is the rate obtained in 1996, however it is confirmed in the supplemental study that the cost of daily goods has not raised much, it is applicable to the situation now.

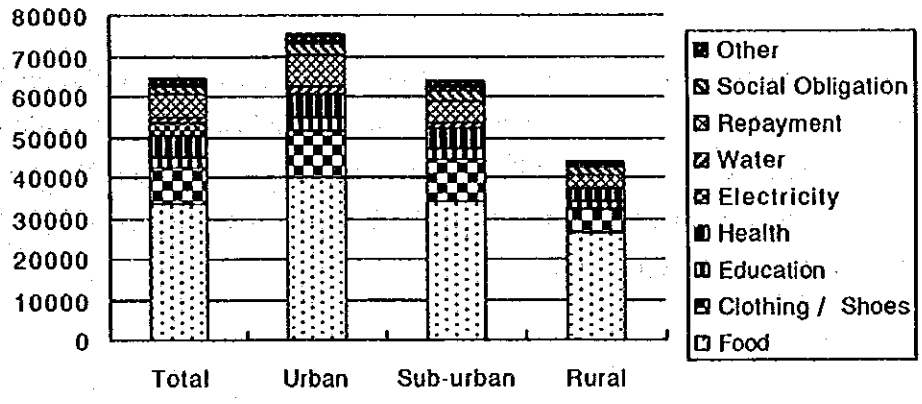


Fig.2.2.5 Monthly expenditure (%)

Clearly the life in urban area is more expensive, the difference comes from mainly cost of food and repayment of debt.

Among population, bank saving is not very common, only 17 % of the people use bank. This rate is highest among urban population (27.6%) and lowest among rural (6%). This is due to difference of the financial situation and availability of the service.

In urban area, it is found more concrete and brick houses than traditional houses, in sub-urban area brick and traditional houses are more commonly found. In rural area about three quarter of the houses are traditional. People in CAR generally put priority to build houses. When they can afford they build concrete house rather than brick and traditional house. The cost of building differs tremendously between concrete houses and bricks or traditional houses (about 20 times more) since most material is imported.

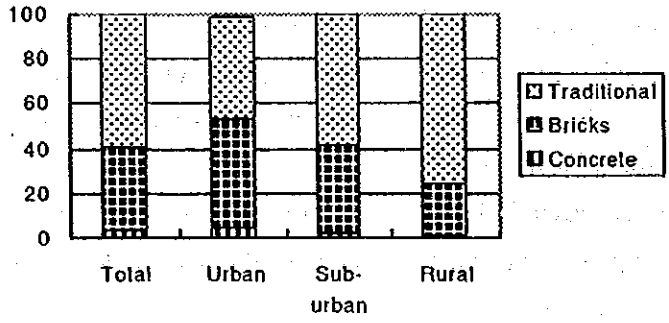


Fig.2.2.6 Type of the house (%)

Fig. 2.2.7 shows the status of land occupation. Generally legal owner of the land is rear, because official regulation of land ownership is too complicated and traditional/ customary regulation is still existing. In addition in urban area, there are more temporary staying people, the reason is assumed that the city center became commercial center rather than residential area, legal occupation is less.

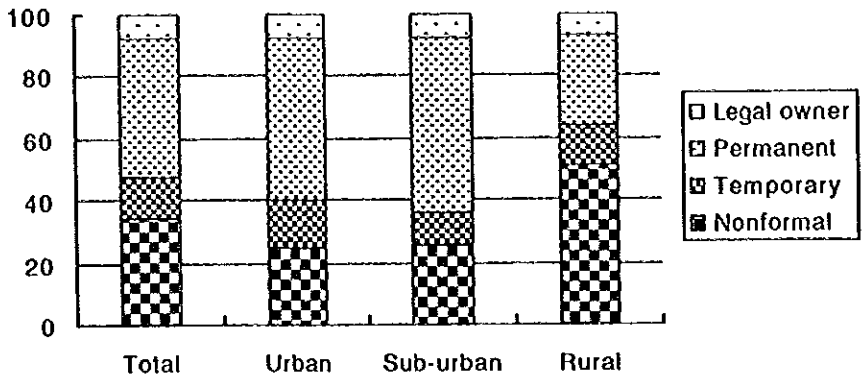


Fig. 2.2.7 Status of land occupation (%)

The electrification rate in Bangui is 6%. The extension of electrification is more than water supply. Most common fuel used is wood. Other type of fuel is very rare. Only 13% use improved stove. If the population increases as quick as now, there would be shortage of fuel wood around Bangui area.

The common meal in CAR is Goso (staple food: cassava, plantain) Gunzin (Vegetable dish) together with meat or fish. People normally take one big dinner a day. The climate in CAR is good enough to produce sufficient crop to feed its small population, however caloric intake of CAR is low (87% of requirement : UN human development index 1992) .